The Blinker Intersection

Analysis of Possible Improvements to the Intersection of
Barnes Road and the Edgartown – Vineyard Haven Road in Oak Bluffs

Prepared for the Town of Oak Bluffs by the Martha's Vineyard Commission
May 2006
(revised June 2006)

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Cover photo: The Blinker intersection today

1 Introduction

The intersection of Barnes Road and the Edgartown – Vineyard Haven Road in Oak Bluffs (commonly referred as the Blinker, the Blinker Light, or the Blinking Light) is one of the most critical intersections on Martha's Vineyard. It has been the subject of considerable discussion in recent year as to what is the best long-term solution for providing safe, efficient movement of vehicular, bicycle and pedestrian traffic at this central crossroads. This report was prepared by the Martha's Vineyard Commission at the request of the Oak Bluffs Board of Selectmen in order to outline the pros and cons of various possible improvements.

Background

The Edgartown – Vineyard Haven Road is the major road, carrying 52-60% of the vehicles entering the intersection, 60% of which go straight through the intersection. Barnes Road carries 40-48% of the vehicles, only 40% of which go straight.

When it was a two-way stop, the Blinker intersection saw considerable traffic delays during the summer season, and had a high rate of accidents, including several serious ones. A key problem was that drivers on Barnes Road, frustrated at waiting at the stop sign, misjudged their ability to squeeze into or across gaps in the fast-moving traffic on the Edgartown – Vineyard Haven Road.

In 2001, the Oak Bluffs Board of Selectmen commissioned a study by MS Transportation Systems that looked at five alternative ways to improve safety at the Blinker while maintaining or improving its level of service. The first four alternatives involved either installing turn lanes, a four-way stop, and/or traffic signals. MS Transportation recommended against the four-way stop except as an interim safety measure. It recommended either the addition of a traffic signal or the fifth alternative, construction of a modern roundabout. Based on that report, the Selectmen elected to build the roundabout as the solution that would provide the greatest safety, the best overall level of service for traffic, and would harmonize most with the character of the Vineyard. The project was programmed in the Vineyard's 5-year Transportation Improvement Program (TIP) for construction in FY2005, with construction costs to be funded by the state and federal governments and the Town assuming the engineering fees.

In July 2003, after a series of accidents, the Selectmen decided immediate action was needed and converted the intersection into a four-way stop as an interim measure. This has been successful in reducing the accident rate, although the intersection now experiences considerable back-ups on the Edgartown – Vineyard Haven Road during the summer period.

Following the normal schedule of transportation projects in the TIP, in September 2004 the Town of Oak Bluffs carried out a selection process for a firm of engineers to design the roundabout. The Town selected the firm of Greenman-Pedersen, Inc. to design the roundabout; however, before the contract could be signed, the selectmen rescinded their decision to build the roundabout in response to public concerns about the impact on abutters, the overall traffic impacts, and bicycle

safety. They asked the Martha's Vineyard Commission to prepare monitor the use of the intersection over the coming year and prepare a report that looked at all aspects of this issue.

Purpose of This Report

The purpose of this report is to analyze the current situation and various possible operational and safety improvements to the Blinker intersection. This report summarizes the relevant sections of the 2001 MS Transportation report and includes additional information obtained since then. During the summer of 2005, the MVC analyzed the use of the intersection. We also sought clarification of some of the issues that had been brought up in the fall of 2004.

Summary of Conclusions

This report looks at five alternatives for the intersection design and evaluates them on the basis of a number of criteria. The following table summarizes the results which are described in more detail later in this report.

Synopsis of Comparison of Alternatives

	Alternative 1 ***Four-way Stop*** *Existing Geometry*	*Alternative 2* **Four-Way Stop** *Right Turn Lane*	*Alternative 3* **Traffic Signal** *Existing Geometry*	*Alternative 4* **Traffic Signal** *Turning Lanes*	*Alternative 5* **Roundabout**
Safety – vehicles					
Safety – bicycles and pedestrians					
Level of Service					
Air Quality					
Landscaping and Character					
Impact on Abutters					
Cost					

Favorable Impact *Unfavorable Impact* *Quite Unfavorable Impact*

2 Context and Existing Situation

2.1 Location and Adjacent Land Uses

The Blinker intersection is seen in some ways as the center of the Island. It is the crossroads of two of the main cross-Island roads. . . heavily used, straight, inland roads. Also, it is close to the population centroid of the Island. Edgartown – Vineyard Haven Road is the most direct of the three road links between these two towns. Barnes Road north of the intersection leads towards downtown Oak Bluffs; south of the intersection Barnes Road leads to the Airport Business Park and the airport, and the road connecting Edgartown to West Tisbury.

The nearby area is lightly settled and maintains a wooded, rural character. The adjacent land uses are:

- On the northwest corner – the Weahtqua Springs Preserve, a protected open space belonging to the Martha's Vineyard Land Bank,
- On the northeast corner – a rental business (Tilton Rentall),
- On the southeast corner – three houses recently renovated or built by Habitat for Humanity as well as, nearest the intersection, open space protected by the Martha's Vineyard Land Bank;
- On the southwest corner – Vineyard Youth Tennis, again, with open space adjacent the intersection protected by the Martha's Vineyard Land Bank.

The Martha's Vineyard Regional High School is located a half-mile to the east and the Goodale gravel pit a quarter-mile to the west.

2.2 Public Transit

Presently, three bus routes pass through the intersection. When the intersection was a two-way stop, and now that it is a four-way stop, delays during the summer compromise the quality of transit service and result in additional costs to the Vineyard Transit Authority.

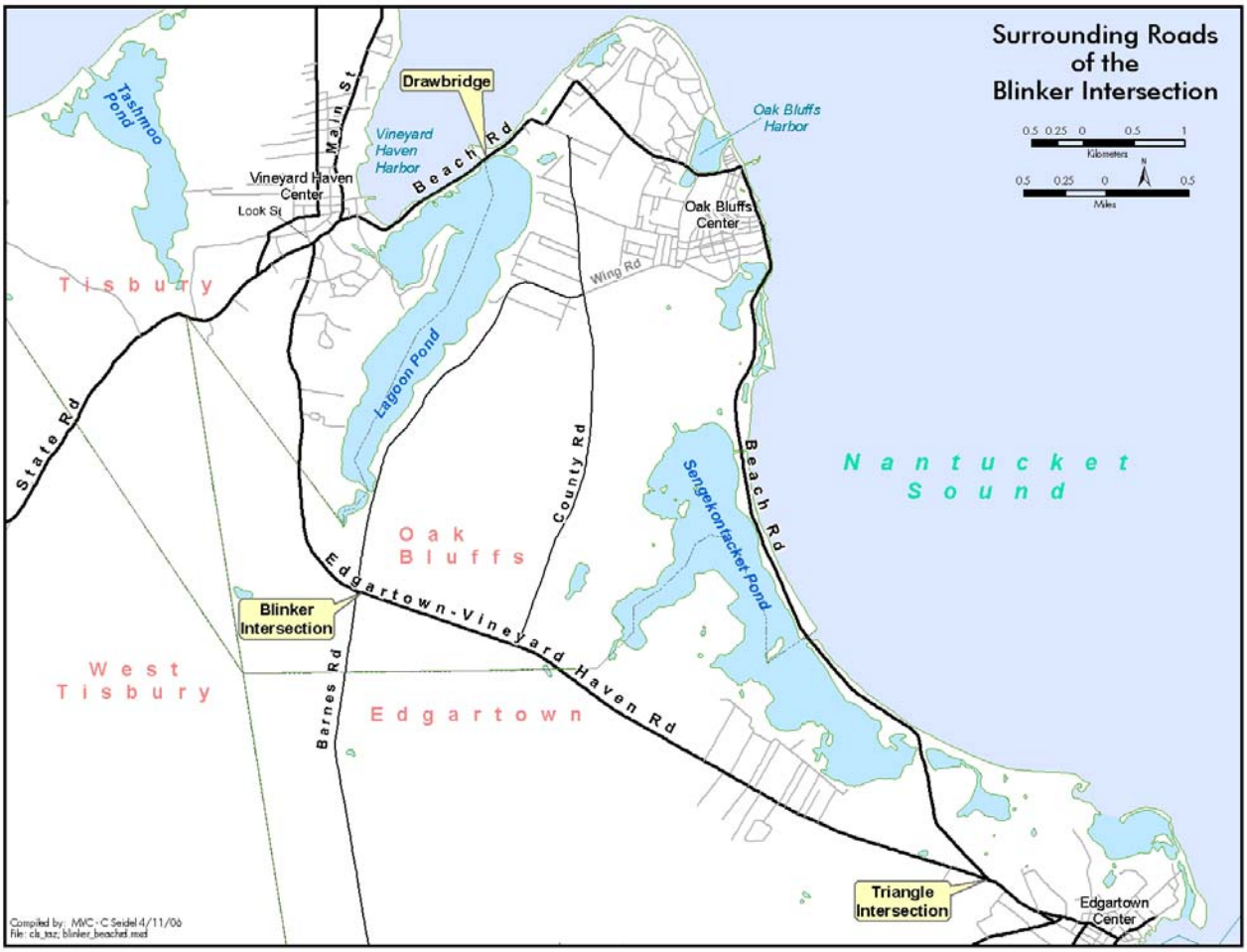
2.3 Bicycles and Pedestrians

There is an 8'-wide multi-user path (MUP, a.k.a. bike path) that runs along the south side of the Edgartown – Vineyard Haven Road. Use of this path is moderate, about 50-100 bikes per hour, less than half the volume of the busiest path on the Vineyard, which runs along Beach Road from Oak Bluffs to Edgartown.

This MUP connects to another MUP that runs along the west side of Barnes Road and links to the extensive network of paths in the State Forest.

3 Existing Traffic and Projected Growth

3.1 Regional Road Network



There are three main routes connecting Vineyard Haven and Edgartown:

- The Edgartown – Vineyard Haven Road;
- The route along Nantucket Sound including Beach Road;
- A route along Beach Road from Vineyard Haven to County Road, down County Road to the Edgartown – Vineyard Haven Road, and along that road into Edgartown.

All three routes end at intersections that currently have high degrees of congestion: the Edgartown Triangle at the east, and either the Edgartown – Vineyard Haven / State Road intersection or Five Corners to the east.

The second of these routes passes through areas of significant population density, close to the traffic conflicts and high pedestrian activity associated with adjacent commercial and recreational uses

such as downtown Oak Bluffs and several beaches. This is also true, to a more limited extent, of the third route.

Traffic on the second and third routes is occasionally totally interrupted because the Lagoon Pond Drawbridge, located between Tisbury and Oak Bluffs, is closed to vehicular traffic The poor condition of the existing drawbridge and the construction of its replacement may lead to more disruptions to traffic on Beach Road in the future At these times, all the traffic is shifted to the Edgartown – Vineyard Haven Road resulting in extended delays. Backups have extended from the Blinker past the Tisbury Town line (almost two miles) and delays were reported to be more than a half hour.

As described in section 3.3, the fact that the four-way stop acts as a bottleneck on the Edgartown – Vineyard Haven Road induces a certain percentage of motorists traveling between Edgartown and Vineyard Haven to travel along alternate routes, resulting in associated traffic and safety problems in the more heavily populated and pedestrian-oriented areas.

Some people, wanting to avoid the congestion at the Edgartown Triangle, take a fourth route from Vineyard Haven to Edgartown, down Barnes Road to the airport and then taking the Edgartown - West Tisbury Road into Edgartown.

The Blinker Intersection also serves as:

- an alternative route for Vineyard Haven to Oak Bluffs traffic,
- an alternative route from Oak Bluffs to Edgartown,
- a route for Up-Island traffic heading into Oak Bluffs,
- a route for traffic to and from destinations in the interior of the Island, especially in the vicinity of the intersection itself, including the High School, Island Elderly Housing, Community Services, Goodale's pit, and quite a number of residential subdivisions.

3.2 Geometry and Traffic Operations

Presently, the Edgartown – Vineyard Haven Road is made up of two 12' lanes with narrow paved shoulders and adjacent grassy shoulders. Barnes Road is made up of two 9' lanes. The intersection is extremely wide, providing for easy turning movements for large trucks but also resulting in a large expanse of asphalt. Both roads have posted speed limits of 35 mph and a double centerline close to the intersection. There is one stop sign located at each leg of the intersection as well as advance warning signs.

3.3 Volumes

During the summer, the average daily traffic (ADT) on the Edgartown-Vineyard Haven Road west of the Blinker is about 14,000 vehicles and it is about 10,800 vehicles on Barnes Road south of Blinker. In the winter, the ADT levels drop to about 8,400 vehicles and 5,200 vehicles in these locations, respectively.

Summer traffic volumes on Barnes Road have increased considerably in the past five years, presumably reflecting general growth of traffic on the Island but also the fact that the congestion formerly associated with the two-way stop has been dramatically reduced. On the other hand, there has been virtually no growth on the Edgartown – Vineyard Haven Road, probably because the presence of the stop sign and the associated congestion has stifled increases in traffic on this road, and shifted over to other Vineyard roads.

Summary of Observed Daily Traffic Data						
Location /Year	***Average Daily Traffic***		***Weekday Peak Hour***		***Saturday Peak Hour***	
	Weekday Volume	*Saturday Volume*	*Volume (Vehicles)*	*%*	*Volume (Vehicles)*	*%*
Edgartown –Vineyard Haven Road West of Barnes Road						
February 2006	*8,812*	*7,678*	*741*	*8.4%*	*718*	*9.4%*
August 2005	*14,103*	*13,533*	*1122*	*8.0%*	*1237*	*9.0%*
August 2000	*14,230*	*13,820*	*1,185*	*8.3%*	*1,140*	*8.3%*
Edgartown –Vineyard Haven East of Barnes Road						
February 2006	*6,727*	*6,037*	*568*	*8.4%*	*579*	*9.6%*
August 2005	*9,972*	*9,406*	*698*	*7.0%*	*714*	*7.6%*
August 2000						
Barnes Road South of Edgartown –Vineyard Haven						
February 2006	*4,916*	*3,889*	*422*	*8.6%*	*394*	*10.1%*
August 2005	*10,209*	*10,129*	*931*	*8.4%*	*826*	*8.2%*
August 2000	*7,860*	*7650*	*675*	*8.6%*	*650*	*8.5%*
Barnes Road North of Edgartown –Vineyard Haven						
February 2006	*3,248*	*2,501*	*276*	*8.5%*	*217*	*8.7%*
August 2004	*6713*	*6412*	*574*	*8.6%*	*504*	*7.9%*
August 2000	*6,440*	*6,720*	*565*	*8.8%*	*670*	*10.0%*

The analysis of recent years peak hour turning movement counts doesn't indicate much growth in the total intersection peak-hour traffic. However, to be conservative, a 15% increase in the traffic is projected for the next ten years; this is the same growth rate used in the MS Transportation study.

Summer Peak Hour Turning Movement Counts *Including percentage of approach volume and, for totals, percentage of total intersection volume*								
	Current 2005 Turning Movement Counts				***Future 2015 Turning Movement Counts***			
	Edgartown - Vineyard Haven Road		***Barnes Road***		***Edgartown - Vineyard Haven Road***		***Barnes Road***	
	Eastbound	*Westbound*	*Northbound*	*Southbound*	*Eastbound*	*Westbound*	*Northbound*	*Southbound*
AM Peak								
Left turn	*78/17%*	*88/22%*	*139/44%*	*98/42%*	*90/18%*	*101/22%*	*160/44%*	*113/42%*
Through.	*248/56%*	*280/71%*	*111/35%*	*110/35%*	*285/56%*	*322/71%*	*128/35%*	*127/47%*
Right turn	*120/27%*	*29/7%*	*67/21%*	*25/21%*	*138/27%*	*33/7%*	*77/21%*	*29/11%*
Approach Totals	*446/32%*	*397/28%*	*317/23%*	*233/17%*	*513/32%*	*456/28%*	*365/23%*	*269/17%*
PM Peak								
Left turn	*120/26%*	*78/21%*	*157/40%*	*40/11%*	*138/26%*	*90/21%*	*181/40%*	*46/11%*
Through	*212/46%*	*257/69%*	*179/45%*	*157/42%*	*244/46%*	*296/69%*	*206/45%*	*181/42%*
Right turn	*128/28%*	*35/9%*	*59/15%*	*176/47%*	*147/28%*	*40/9%*	*68/15%*	*202/47%*
Approach Totals	*460/29%*	*370/23%*	*395/25%*	*373/23%*	*529/29%*	*426/23%*	*455/25%*	*429/23%*

3.4 Speed

All approaches to the intersection are posted 35 mph speed limits. Since July 2003, all cars stop at the intersection. Before the stop signs were installed on the Edgartown – Vineyard Haven Road, the MS Transportation study reported average speeds on that road of 40 mph and 36 mph in the eastbound and westbound directions respectively.

3.5 Safety

When the intersection was a two-way stop, the accident rate had been much higher than district or state averages for similar intersections. After the town of Oak Bluffs changed the intersection from a two-way to a four-way stop, total yearly crash rates declined 58% (from 7.2 to 3 per year) with failure-to-yield type collisions declining by 74% (from 3.8 to 1 per year) and personal injury incidence declining 42% (from 2.6 to 1.5 per year).

Number of Crashes *Barnes / Edgartown – Vineyard Haven Roads Intersection (1998-2004)*						
1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
3	*6*	*9*	*8*	*10*	*4*	*2*

Source: Mass Highway Crash Data

3.6 Sight Distances

MS Transportation reported that there are adequate sight distances in all directions. The recommended stopping sight distances are 325 feet and 400 feet and the recommended corner sight distances are 415 feet and 465 feet respectively for traffic traveling at 40 or 45 mph. Presently, the sight distances are greater than 450 feet in all directions.

3.7 Delays and Level of Service

Operational efficiency of an intersection is measured by its level of service (LOS). For a regular intersection controlled by stop signs or signals, the LOS is based on the average time it takes to get through the intersection, measured on a scale of A to F. For a roundabout, the LOS is measured by the ratio of traffic volume to roadway capacity.

When it was a two-way stop, the summertime LOS was A on the Edgartown – Vineyard Haven Road and F on Barnes Road. Heading towards the intersection from the airport, the average delay during the afternoon peak hour was more than two minutes.

Now that it is a four-way stop, the problem has flipped to the other road. Although the LOS on Barnes Road is still F, the delays have been reduced considerably, whereas the LOS on the Edgartown – Vineyard Haven Road has dropped to F, with delays averaging eight minutes during peak hours in the summertime and going up to as much as twenty minutes during the observation periods.

Table : Level of Service (LOS) Criteria for Intersections

Level of Service	***Signalized Intersections*** *Control Delay (seconds/vehicle)*	***Unsignalized Intersections*** *Average Control Delay (seconds/vehicle)*	***Roundabouts Average Control*** *Delay (seconds/vehicle)*
A	*≤10*	*≤10*	*≤10*
B	*>10-20*	*>10-15*	*>10-15*
C	*>20 -35*	*>15 -25*	*>15 -25*
D	*>35 - 55*	*>25 - 35*	*>25 - 35*
E	*>55 -80*	*>35 -50*	*>35 -50*
F	*>80*	*>50*	*>50*

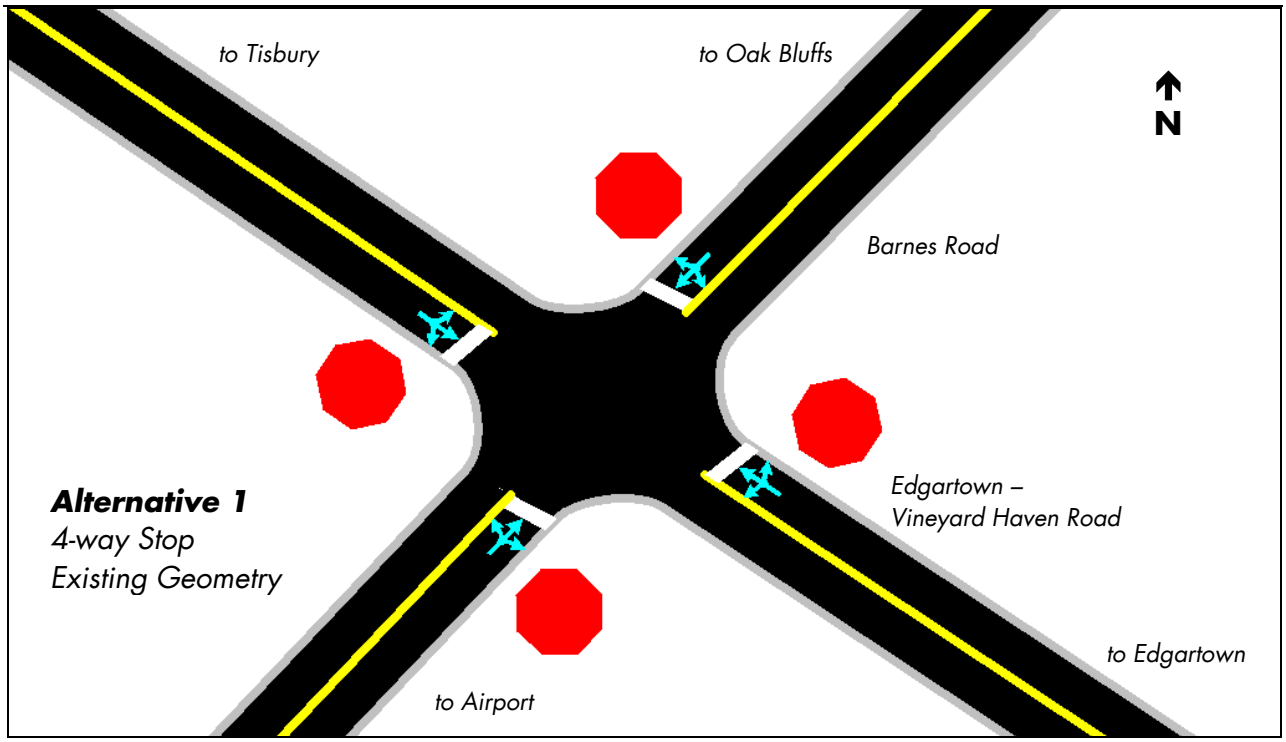
4 Identification of Alternatives

The following alternatives are analyzed in this report:

1) a four-way stop using the existing geometry,
2) a four-way stop with the addition of a turning lane,
3) a traffic signal using the existing geometry,
4) a traffic signal with the addition of turning lanes,
5) a modern roundabout.

We did not examine the possibility of reverting back to a two-way stop as we assumed that this would be unacceptable for safety reasons. Based on preliminary concepts, it appears that there is sufficient right-of-way to accommodate the roadway work associated with each alternative. Routing of the MUP (bike path) along the southerly side of the intersection may require passing into private property in the southeast and southwest quadrants of the intersection; however there are agreements in effect on both properties to allow impinging onto these properties as part of a project to improve the intersection. All alternatives would be designed to handle trucks of every legal size that travel on public roads in Massachusetts.

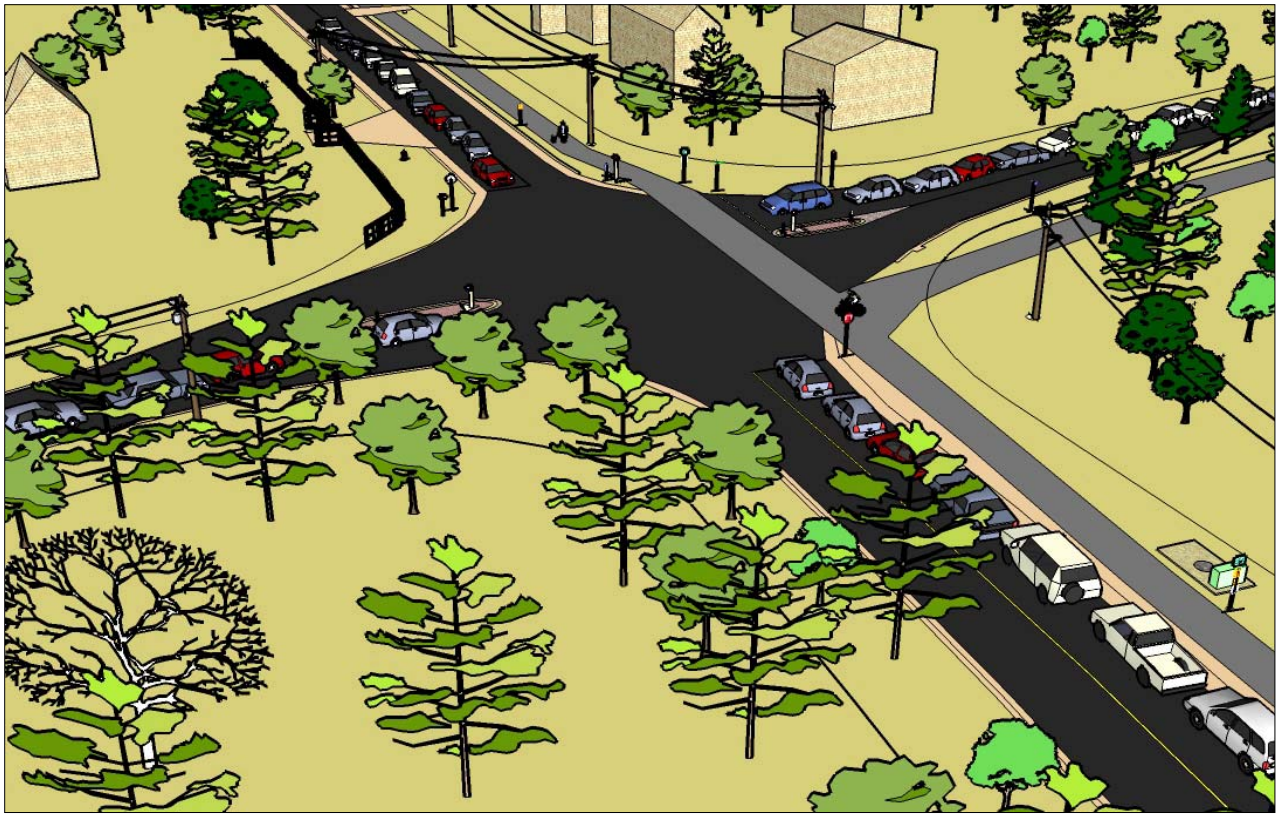
4.1 Four-Way Stop – Existing Geometry



Existing Geometry - Plan View

In its 2001 report, MS Transportation indicated that installing a four-way stop would improve safety as well as reduce delays on Barnes Road, whereas the LOS on the Edgartown – Vineyard Haven Road would go down considerably, mainly because the free-flowing traffic would now be required to stop, resulting in long line-ups at peak periods. This has proven to be the case.

to Edgartown



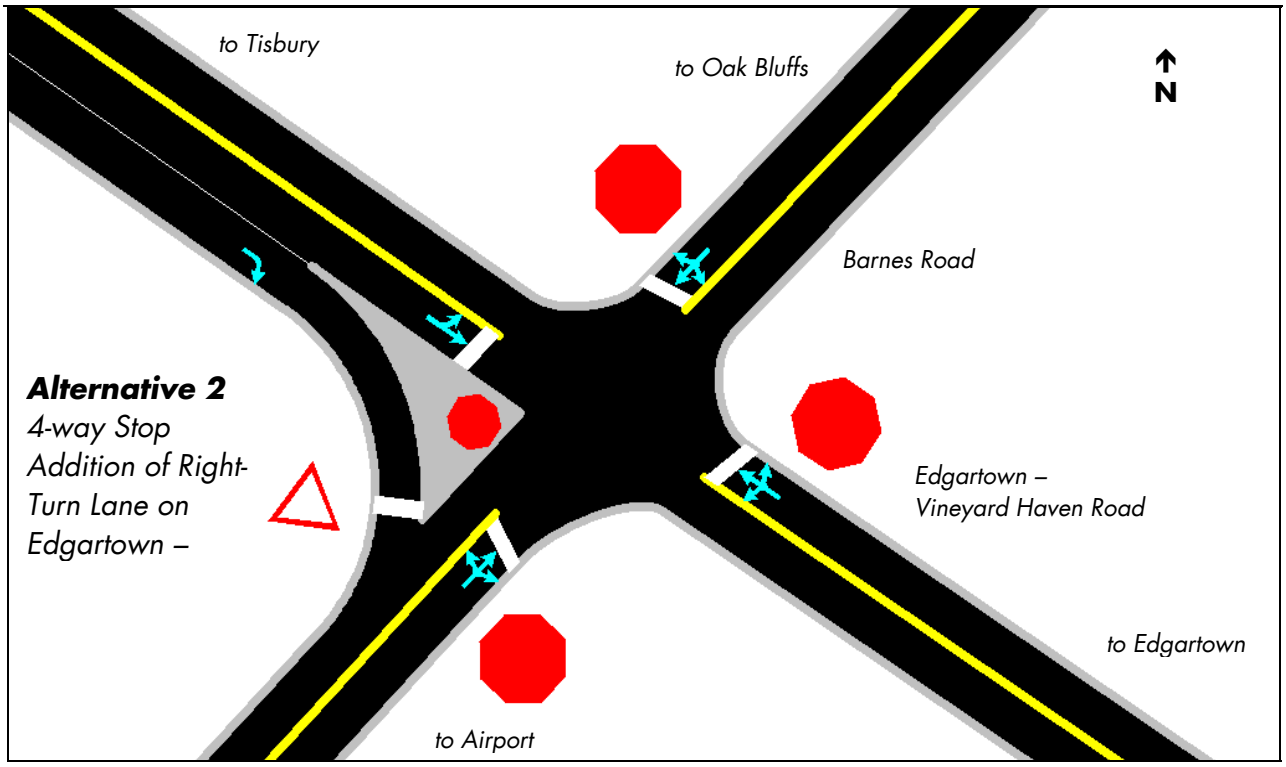
to Oak Bluffs

to Airport

to Tisbury

Existing Geometry – Conceptual View

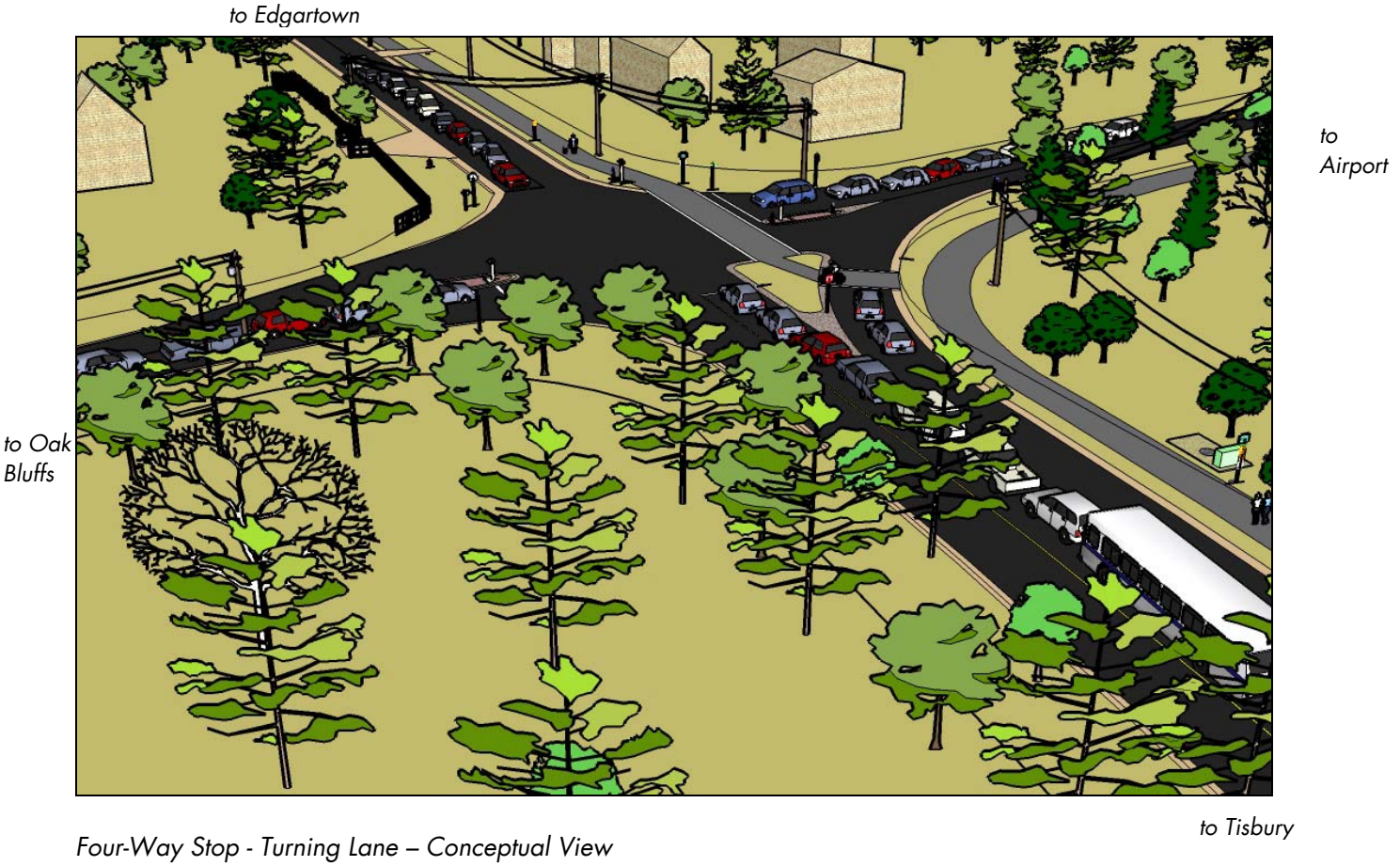
4.2 Four-Way Stop – Turning Lane



Four-Way Stop - Turning Lane - Plan View

The introduction of turning lanes improves the LOS of an intersection by allowing vehicles making more difficult, or more frequent movements to be stacked in a separate lane, thereby removing them as obstacles to movement in the other lane.

In its 2001 study, MS Transportation identified the possibility of adding a turning lane to each road leading into the intersection (as outlined in section 4.4). Subsequently, MS Transportation advised against adding any turning lanes as it would be unsafe to have an intersection controlled by a four-way stop with multiple entry lanes. A 4-way stop depends upon giving right-or-way to the vehicle that arrived first, but with two side-by-side lanes of traffic entering the intersection from one or more directions, it is unclear among drivers at the other stop signs as to who has the right-of-way.

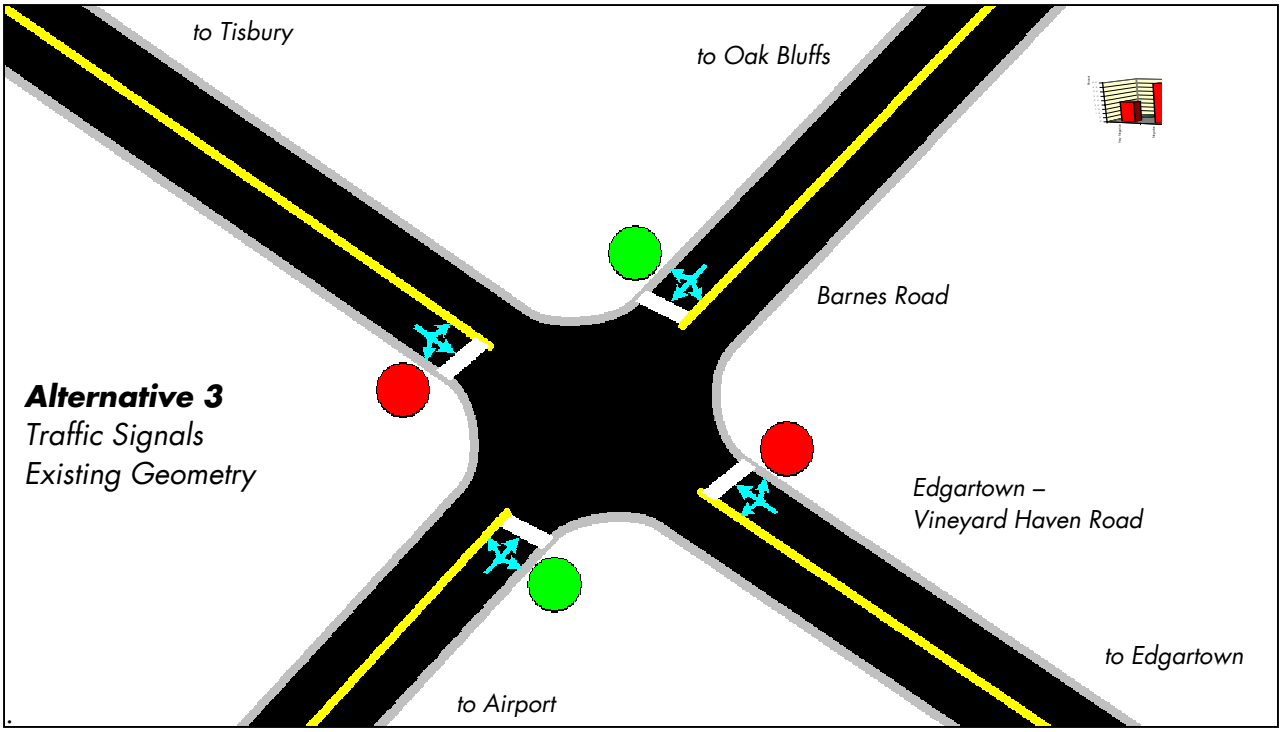


Four-Way Stop - Turning Lane – Conceptual View

Based on further discussion with several transportation consultants, it was decided to analyze the possibility of adding one turning lane, namely a right-turn lane for traffic traveling eastbound on the Edgartown – Vineyard Haven Road and heading down to the Airport. The turning lane could be designed as a lane with a storage length of 250ft. Both designs might involve changing the alignment of the MUP and might require additional right-of-way. At the site visit and public information meeting held in May 2006, it was pointed out that in the illustration shown above, the storage area is only large enough for a few cars and would have little impact on congestion. To be more effective and create a turning lane 250 feet long would likely require relocating the telephone switching box (seen to the right of the illustration) at an additional cost of approximately $125,000.

The possibility was briefly analyzed of making the right-hand lane a separate by-pass road entering perhaps 400' west of the intersection and exiting on Barnes Road with a yield sign. However, this was not pursued because it would produce serious conflicts with the multi-user path, would require construction outside the public road layout, would require cutting of many mature trees, would be quite costly, would lead to creation of an additional conflict point on Barnes Road, and would not result in a level of service that would be acceptable in the long term.

4.3 Traffic Signal – Existing Geometry

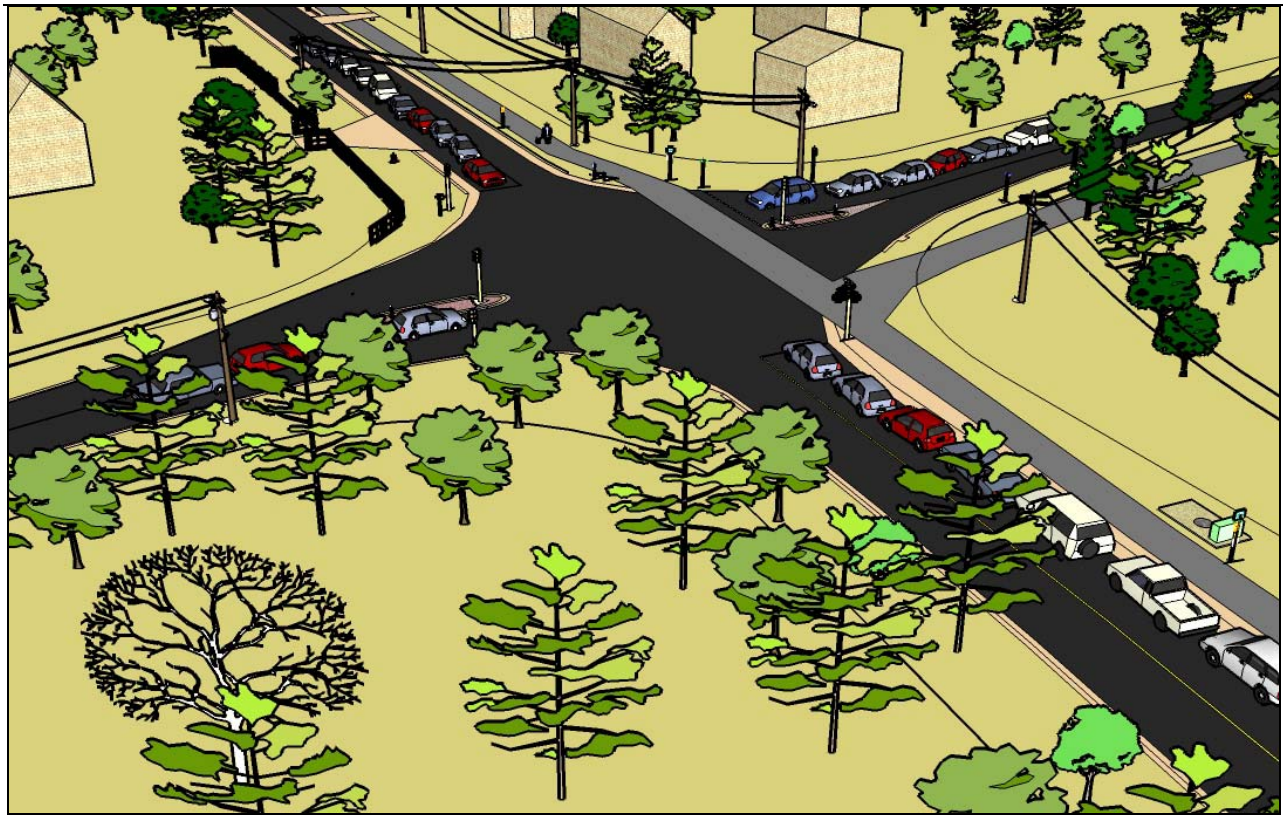


Traffic Signal – Plan View

This alternative involves installing a traffic signal at the existing intersection without making any other physical changes

to Edgartown

to Airport

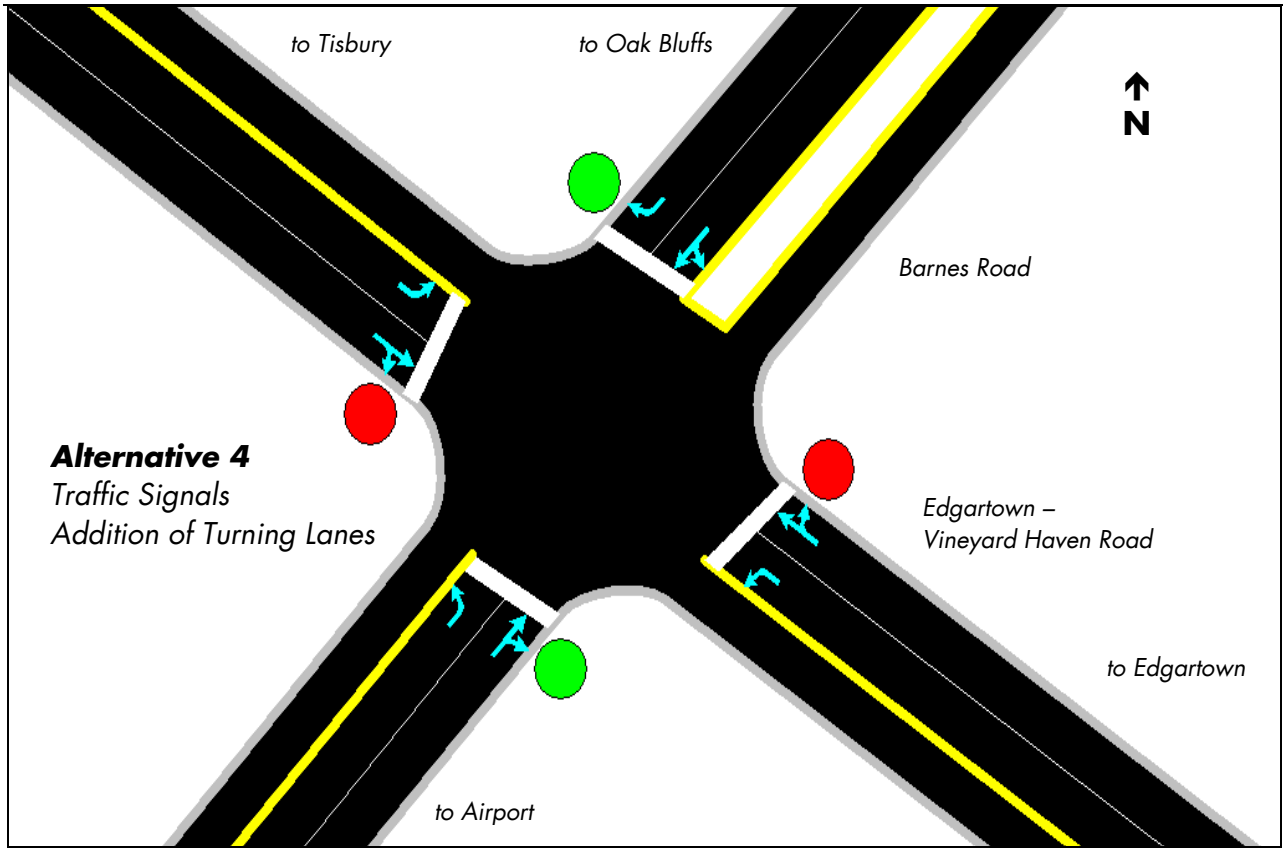


to Oak Bluffs

Traffic Signal - Conceptual Layout

to Tisbury

4.4 Traffic Signal – Turning Lanes

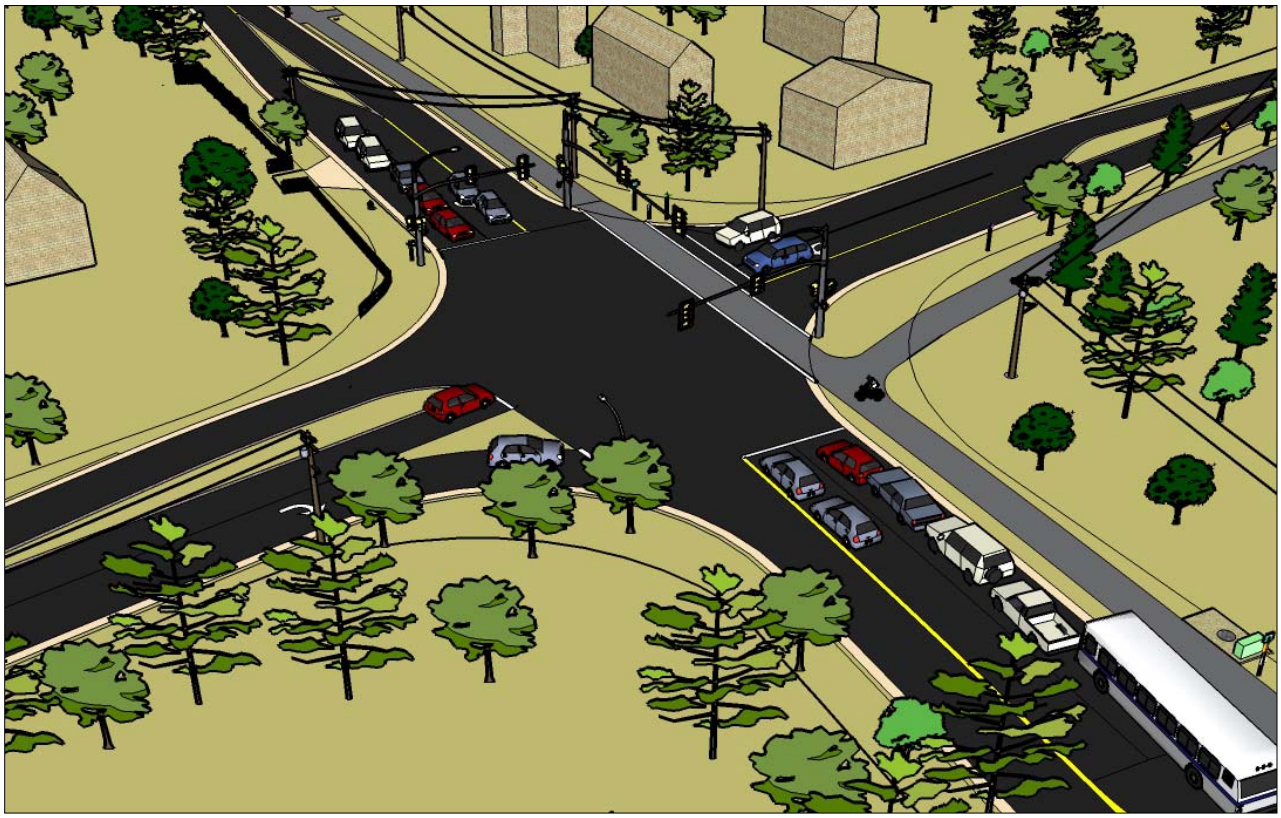


MS Transportation identified the following as the most useful scenario for the addition of turning lanes to the intersection if controlled by traffic signals:

- A left-turn lane on the Edgartown – Vineyard Haven Road in both the eastbound and westbound directions,
- A left-turn lane on Barnes Road in the northbound direction,
- A right-hand lane on Barnes Road in the southbound direction. Note that this involves additional widening so that these lanes line up with those on the other side of the intersection.

to Edgartown

to Airport

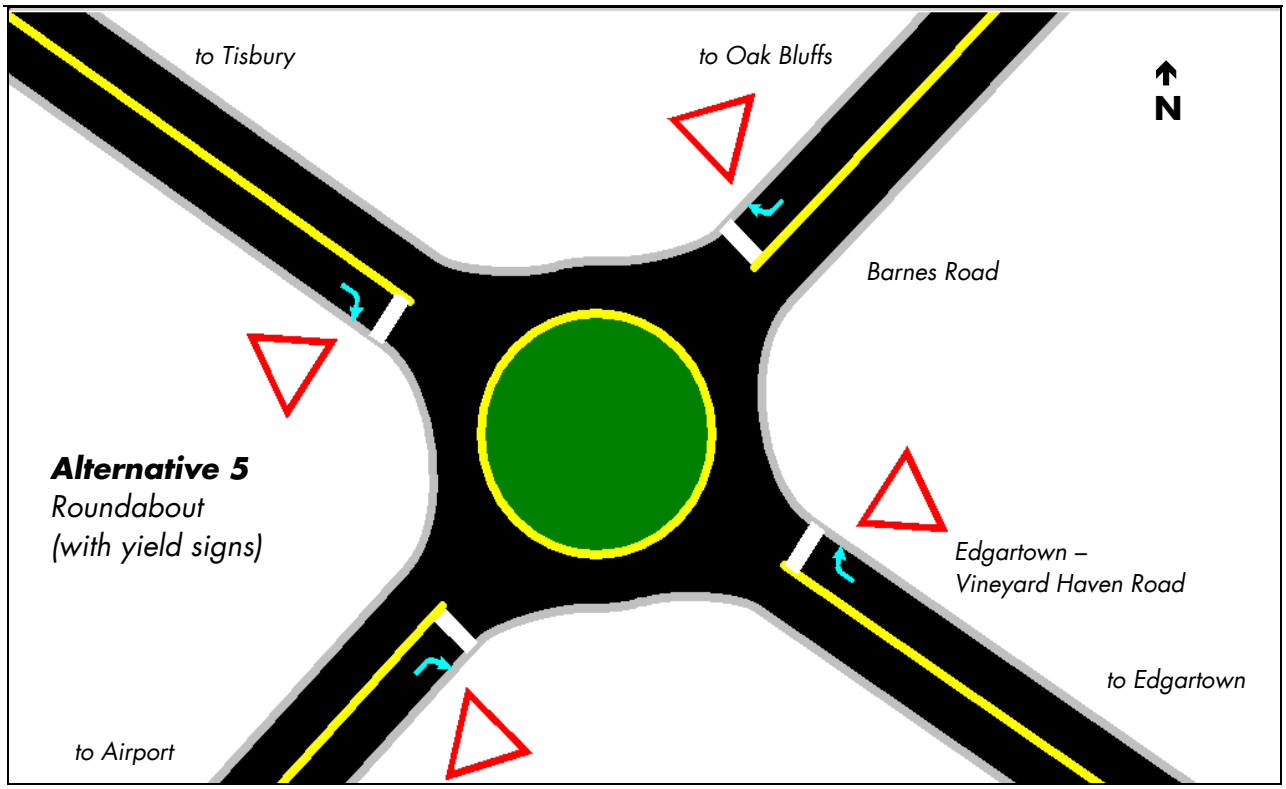


to Oak Bluffs

to Tisbury

Traffic Signal with Turning Lanes - Conceptual View

4.5 Roundabout

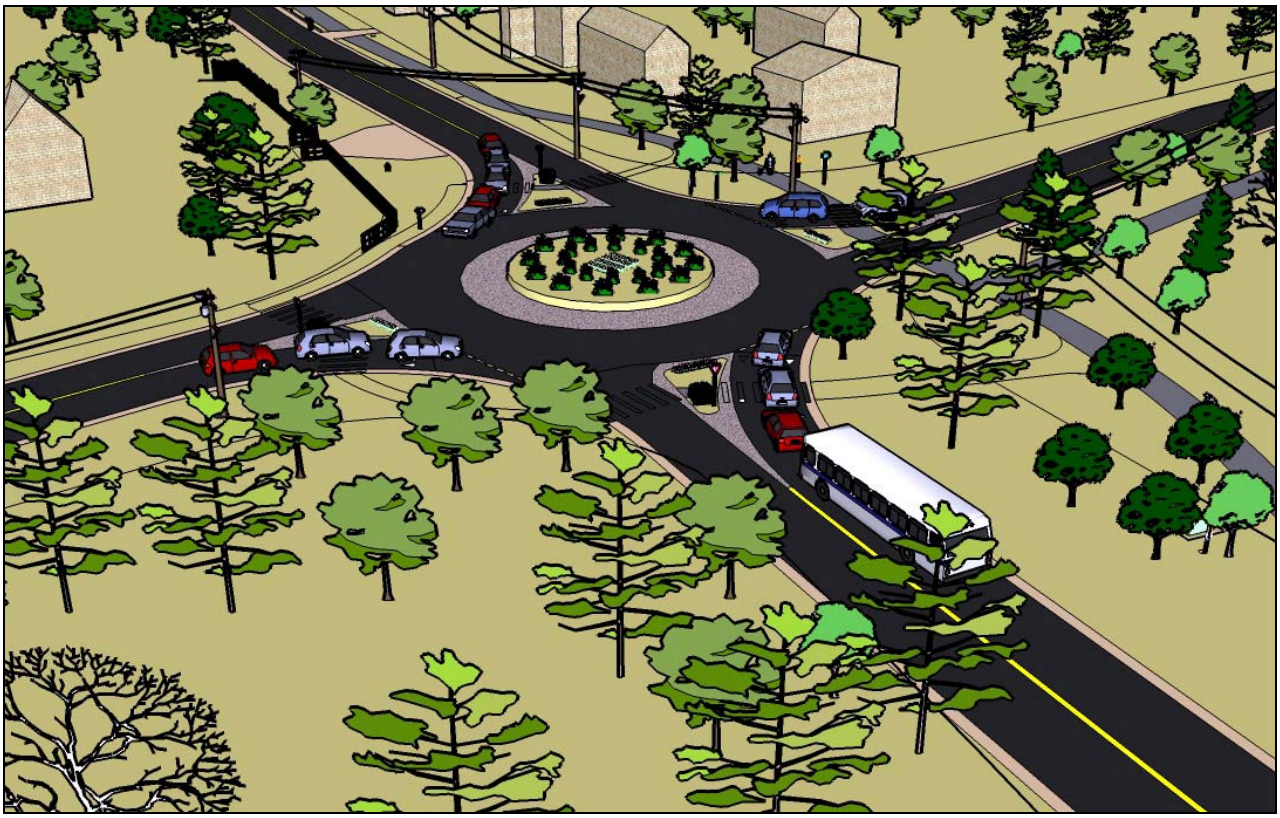


Roundabout - Plan View

This alternative involves constructing a single-lane modern roundabout – "a revolving door for vehicles" – in place of the right-angled intersection. This involves splitter islands – triangular islands just before the roundabout that split incoming and outgoing traffic – and one-way flow around a small central landscaped circle about 70' in diameter. .

Though they are both circular, a modern roundabout is very different from a traditional rotary or traffic circle. Old-style rotaries are large, multi-lane, high speed (30-50 mph), require weaving movements, and are dangerous; they are being eliminated across the nation. Modern roundabouts are small scale, single lane, slow speed (10-15 mph), without weaving movements, and very safe. They are commonly used elsewhere in the world and, in the past five years, several hundred have been built in the United States. Organizations espousing more innovative, context-sensitive approaches to traffic management than the traditional engineering solutions often promote the use of roundabouts..

to Edgartown



to Airport

to Oak Bluffs

to Tisbury

Roundabout – Conceptual View

There is one modern roundabout on the Cape, on route 149 at Marston's Mills, next to the Cape Cod Airfield. There had been long traffic backups at this intersection for many years, when it was a four-way stop. Despite some public opposition including a petition against it, the Town of Barnstable built the roundabout in 1999. Since then, there are no traffic backups and the roundabout enjoys widespread, though not universal, public support. The Town of Nantucket has decided to install its first modern roundabout to replace a four-way intersection with three stops; the project is currently being advertised for construction in the fall

5 Analysis of Alternatives

5.1 Safety

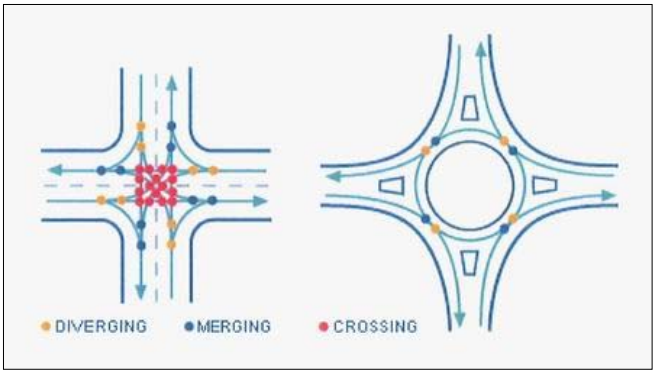
Right-Angled Intersections: There are certain safety issues associated with all right-angled intersections. They depend on drivers' respect for signage to ensure safety rather than the physical configuration of the roadway. Red-light and stop-sign running is an increasing problem and is especially problematic because the consequences of a right-angled (T-bone) crash can be very serious. With all right-angled intersections, there are 32 potential conflict points regardless of the type of intersection control (16 crossing, 8 merging, and 8 diverging points – see illustration on next page). An additional safety concern was raised at the public information meeting held to discuss the intersection in May 2006, namely that the presence of a long line of vehicles backed up along the Edgartown – Vineyard Haven Road blocked the visibility of moving traffic in the opposite lane for trucks exiting from Goodale's pit.

Crash Rates for Rural Right-Angled Intersections		
	Average Annual Number of Crashes per Intersection	*Average Crash Rate per Million Entering Vehicles*
Two-Way Stop	*2.84*	*0.95*
Four-Way Stop	*3.28*	*0.88*
Traffic Signals	*6.61*	*0.96*
Geometric Categories as Intersection Safety Evaluation Tools, John R. Campbell and Keith J. Knapp, 2005 – Analysis of 481 rural intersections in Wisconsin		

Turning Lanes with Four-Way Stop: As mentioned above, although MS Transportation raised the possibility of combining turning lanes with a four-way stop, it later cautioned against this solution because of the safety concern related to confusion over which vehicle would have the right of way. Alternative 2 could provide an acceptable level of safety and would offer some traffic improvement. It might be considered as a temporary measure until a more permanent solution is implemented, if the question can be resolved as to how to safely design it so as not to conflict with the multi-user paths.

The present crosswalk is about forty feet long.

Traffic Signals: Four-way stops have the safety advantage (though the operational disadvantage) of requiring that all vehicles come to a stop whereas with traffic signals, most vehicles would be passing through the intersection at a comparatively high speed. On the other hand, a signal-controlled intersection offers greater clarity with respect to who has the right of way. A recent study by the University of Wisconsin[1] indicates that the average crash rate for a rural four-leg intersection is about the same with traffic signals as with a two-way stop, and both are higher than with a four-way stop.



Vehicular safety in roundabouts: The accident rate of a roundabout is about one third that of a right-angled intersection, according to a National Highway Administration study, namely 1.2 collisions per million vehicles for a roundabout, compared to 3.4 for right-angled intersections. (Note that different studies use different methodologies and it is not possible to compare rates from one to another.) The rate of accidents with personal injuries is even lower. Using these averages suggests that, over the next 50 years at the Blinker intersection, there could be 43 accidents with a right-angled intersection and 16 with a roundabout. Since the Blinker's past accident rate has been higher, a proportional reduction would be even greater. A roundabout reduces the number of conflict points from 32 with a right-angled intersection to 8 (0 crossing, 4 merging, and 4 diverging points).

A study by the Insurance Institute for Highway Safety found in roundabouts "a 39 percent overall decrease in crashes and a 76 percent decrease in injury-producing crashes. Collisions involving fatal or incapacitating injuries fell as much as 90 percent." Roundabouts are safer because it is clearer who has the right of way (the vehicle in the roundabout) and, since all vehicles travel in the same direction at very slow speed, the rare accident is minor.[2]

"The physical configuration of a modern roundabout, with a deflected entry and yield-at-entry, forces a driver to reduce speed during the approach, entry, and movement within the roundabout. This is contrary to an intersection where many drivers are encouraged by a green or yellow light to accelerate to get across the intersection quickly and to "beat the red light" and contrary to old traffic circles where tangent approaches also encourage, or at least allow, high-speed entries. Another important safety factor is that the only movement at an entry and an exit of a roundabout is

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[1] *Geometric Categories as Intersection Safety Evaluation Tools, John R. Campbell and Keith J. Knapp, 2005*

[2] *A December 2002 report by the Maryland Highway Administration indicates that 15 single-lane roundabouts have greatly improved intersection safety in that State. The analysis shows a 100 percent decrease in the fatal crash rate; a 60 percent decrease in the total crash rate; an 82 percent reduction in the injury crash rate; and a 27 percent reduction in the property damage-only accident rate. This report is available for download at http://safety.fhwa.dot.gov., Federal Highway Administration – Research and Technology website*

a right turn, thus reducing the potential frequency and severity of accidents compared to accidents typically occurring during left turns and when traffic crosses an intersection in perpendicular directions."[3]

"Not only do roundabouts reduce the speeds of vehicles through an intersection, but crash angles are limited to 0° - 45°. Crashes are constrained by geometry to low "speed differential" rear-enders and side swipes - i.e., T-bones and Head-ons are eliminated."[4]

Bicycle and Pedestrian Safety in Roundabouts: Statistics are less complete for pedestrian and bicycles in roundabouts.[5] It would appear that the accident rate involving pedestrians drops considerably with the introduction of a roundabout whereas the total accident rate for bicycles is about the same. However, it appears that the severity of accidents is reduced for bicyclists as well, especially with a single-lane roundabout such as would be the case at the Blinker. As with any road or intersection, bicyclists have a choice of moving either with the flow of traffic on the roadway or with pedestrians on the multi-user path.

- When traveling with the traffic, bicyclists encounter fewer conflict points with vehicles, and furthermore, the traffic will be moving at a slow speed, comparable to that of a bicycle.
- Bicyclists choosing not to stay on the road, cross at a crosswalk located about 20' from the circle. Here, all vehicles are approaching from only one direction and facing forward (as opposed to approaching from three directions including turning vehicles, with right-angled intersections) and are still moving very slowly. Pedestrians and bicyclists cross a single lane, and have a refuge on the splitter island before crossing the other lane. This configuration is safer for both pedestrians and bicyclists than right-angled intersections where pedestrians and bicyclists experience more conflicts with turning vehicles, even when in a marked crosswalk. There is no way to stop everyone from running through signals, stop signs, or yield signs; but the geometry of the roundabout forces all vehicles to slow down. Currently, with the four-way stop, the crosswalk is about 40' long, with no refuge and bicyclists and pedestrians are exposed to vehicles coming from several different directions.

5.2 Delays and Level of Service

The MVC transportation planner ran a computer traffic modeling of the intersection of each of the alternatives, using Synchro software, both for the present situation, and for the situation in ten years from now based on the assumption that there would be a 15% growth in traffic, as described in section 3.3. Each successive alternative reduces the delays compared to the previous one.

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[3] *Roundabout Safety Comes to America*

[4] *NorthEast Area Roundabouts*

[5] *Much of the data on bicycle safety is based on older designs including multi-lane circles or circles with separate bicycle lanes within the circle; both practices which are problematic for bicyclists. Separate bicycle lanes are no longer part of current design practice. A British study showed a slightly higher accident rate for bicycles (189 compared to 175 crashes per 10,000,000 vehicles) whereas a Norwegian one showed a 72% reduction (0.37 compared to 1.30 casualties per year for the same intersections). Roundabout Safety Comes to America*

Level of Service for Summer Peak Hour – 2005 *Including Delays in Seconds*					
Approach	*Alternative 1 (Existing)*	*Alternative 2 (Right Turn Lane)*	*Alternative 3 (Traffic Signal)*	*Alternative 4 (Traffic Signal with turning lanes)*	*Alternative 5 Roundabout*
Edg-VH Road Eastbound	*F – 201*	*F – 66*	*C – 21*	*A - 10*	*A – 2*
Edg-VH Road Westbound	*F – 102*	*F – 107*	*B –13*	*A – 10*	*A – 4*
Barnes Road Northbound	*F – 133*	*F – 132*	*C – 22*	*B – 12*	*A – 3*
Barnes Road Southbound	*F – 99*	*F – 99*	*B – 12*	*B –11*	*A – 4*
Intersection Delay	*F - 138*	*F - 99*	*B - 18*	*B - 11*	*A – 3*

LOS A or B *LOS C, D, or E* *LOS F delays < 100sec.* *LOS F - delays > 100sec*

Level of Service for Summer Peak Hour – 2015 *Including Delays in Seconds*					
Approach	*Alternative 1 (Existing)*	*Alternative 2 (Right Turn Lane)*	*Alternative 3 (Traffic Signal)*	*Alternative 4 (Traffic Signal with turning lanes)*	*Alternative 5 Roundabout*
Edg-VH Road Westbound	*F - 285*	*F - 102*	*D - 48*	*B – 12*	*A – 3*
Edg-VH Road Eastbound	*F - 158*	*F - 166*	*B – 18*	*B - 11*	*A – 6*
Barnes Road Northbound	*F - 199*	*F - 199*	*E - 63*	*B – 11*	*A – 4*
Barnes Road Southbound	*F - 155*	*F - 154*	*B – 16*	*A – 9*	*A – 7*
Intersection Delay	*F - 204*	*F - 157*	*D - 37*	*B – 11*	*A – 5*

The addition of the right-hand turning lane in Alternative 2 would cut the present delay by two thirds, although it would still operate at LOS F with a delay of more than a minute during the summer peak hour.

The addition of a traffic signal would result in a significant reduction in delays and improvements in the level of service in most directions. Without any changes to the geometry, the overall LOS at peak hour in 2015 would be D with an average intersection delay of 37 seconds. With the addition of four turning lanes, the overall LOS would be B and the average intersection delay would be 11 seconds.

With the roundabout, the LOS in all directions at peak hour in 2015 would be A and the average intersection delay would be 5 seconds, the best of all alternatives. Because of the higher capacity of a roundabout, all traffic would have to slow down but there would be no obligatory stop. Delays would be short for everyone. Entering drivers often just adjust their speed without stopping to take advantage of approaching gaps in circulating traffic.

5.3 Regional Traffic Impact

The question has been raised as to whether relieving congestion at the Blinker might exacerbate traffic problems elsewhere.

The presence or absence of congestion at the Blinker would not, in itself, affect the operation of other intersections in the Island's road network including the two presently congested ends of the Edgartown - Vineyard Haven Road, both now operating at a level of service of F in the summer peak hours. For example, if 5 vehicles per minute travel westwards through the Blinker towards the Triangle in Edgartown, the flow at the Triangle would be the same whether those vehicles get through the Blinker in 8 minutes or in 8 seconds.

The only impact that easing congestion at the Blinker might have at other locations is if it induces some drivers to change their travel routes, choosing to travel through the Blinker instead of using another road.

Reducing the congestion and increasing the capacity of the Blinker intersection would presumably induce some of the traffic that has shifted to other roads, to return to the Edgartown – Vineyard Haven Road. This would likely lead to a modest reduction in traffic along Beach Road and County Road. Based on the scale of the shift in traffic when the two-way stop was converted to a four-way stop, this impact would be relatively modest. As discussed in section 3.1, even a modest decrease in traffic in the heavily used and settled areas along Beach Road and County Road would be considered positive.

In Tisbury, the impact of the shift of some traffic from Beach Road to the Edgartown – Vineyard Haven Road would likely be a modest reduction of traffic in Five Corners and an increase in traffic in the intersection of the Edgartown – Vineyard Haven Road and State Road (the Look Street intersection). The Town of Tisbury has proposed to build a network of connector roads that are projected to reduce congestion at the Look intersection. Thus, by shifting some traffic from Five Corners to the Look Street Intersection and connector roads, which would be better able to handle it, the net result of a significant improvement to the Blinker should be a modest positive impact to traffic congestion in Tisbury.

In Edgartown, however, shifting some from Beach Road to the Edgartown – Vineyard Haven Road would probably have little impact since both roads connect to the Triangle intersection, which would therefore end up having to deal with the same amount of traffic. The Town of Edgartown and the Martha's Vineyard Commission are looking at various options for improvements in this area.

5.4 Air Quality

Automobile emissions and air pollution are increased when vehicles idle while waiting in stop-and-go traffic or at a traffic signal or stop sign. Emissions also increase when vehicles accelerate, particularly from a standing stop.

The intersection alternatives that have the greatest congestion and where all vehicles are obliged to stop, namely the two alternatives with stop signs, are the worst from an air quality point of view. Traffic signals have the advantage of reducing stop-and-go traffic and allowing more than half of the vehicles to go through the intersection without stopping. A roundabout has the least air quality impact of the alternatives studied because although vehicles slow down, they generally do not stop, and because there is the least overall congestion.

5.5 Landscaping and Character

Existing situation

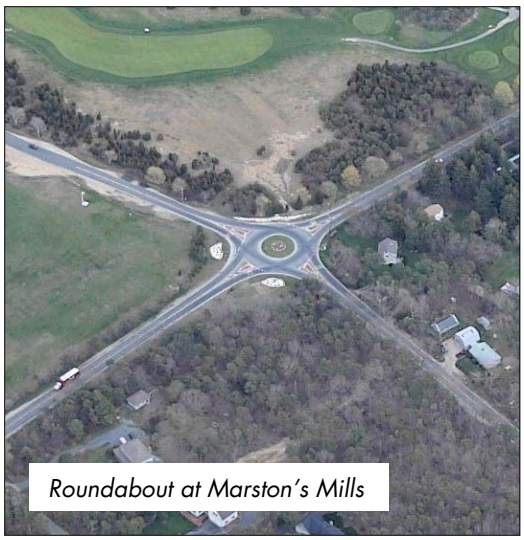
Existing Situation

Existing Geometry: Alternatives 1 and 3 would maintain the intersection's current configuration including the extent of paved roadway and general landscaping character.

Turning Lanes, Orleans

Turning Lanes: Alternatives 2 and 4 involve widening the roads. With alternative 4, each road would be three lanes wide, making it the biggest intersection on the Island.

Traffic Signal: Alternatives 3 and 4 involve making this the Island's only signalized intersection.



Roundabout at Marston's Mills

Roundabout: Since a roundabout would only be one lane wide, it would have an expanse of asphalt closer to that of alternatives 1 and 3. The fact that traffic rotates around a central circle of vegetation would reduce the visual scale of the existing intersection and increase the presence of greenery, with trees and bushes on the visual axis of each of the roads. The Federal Highway Administration handbook about roundabout design recommends that the splitter islands be well landscaped as well, if space and other factors permit. The aim is to allow visibility of approaching vehicles, bicycles and pedestrians, but to avoid a wide-open view that might induce people to speed up. It could be argued that this is similar to the Vineyard tradition of having traffic move around small areas of vegetation at most of the major T intersections on the Island (left photo below). It is a very different scale and design from, say, the Bourne Rotary (right photo).

North Road, Menemsha

Bourne Rotary

5.5 Impact on Abutting Landowners

Access: Probably the most significant impact on abutters is the degree of difficulty residents or visitors have in gaining vehicular access to the property.

- Vehicles accessing a property coming from or leaving in a direction requiring passing through the intersection will be impacted by the delay in the intersection, which, as described above, currently averages 8 minutes and goes up to 20 minutes heading eastbound on the Edgartown –Vineyard Haven Road during summer peak periods.
- Access to abutting properties is impeded when the queue at the intersection extends beyond the entrance driveway. The properties on the northwest, southwest, and southeast corners are located well away from the intersection and would only be affected for limited time periods. However the entrance to Tilton Rentall on the northeast corner is close to the intersection and would be affected for much of the summer and to a lesser extent year-round.
- Vehicles turning left into driveways on the other side of the intersection must also cross the queue on the opposite side of the road. Exiting vehicles might also have to negotiate the queue.

The four-way stop and traffic signal alternatives all would result in regular queuing, which would often extend past the entrance to Tilton Rentall. Vehicles arriving from Oak Bluffs, Vineyard Haven and the Airport (Up-Island) would first have to wait in their respective queues to get through the intersection. Then, they would head eastbound and make a left turn across the queue of westbound vehicles approaching the intersection. Most vehicles both entering and exiting this property have to make difficult left turns.

The roundabout produces little queuing so the majority of vehicles going through the intersection would experience little delay. The proximity of the Tilton Rentall entrance to the roundabout means that vehicles coming from the intersection and turning left to enter the driveway would have to do so immediately at the end of the splitter island, not an ideal arrangement, which could be somewhat improved by moving the entrance somewhat eastward. In both cases, this arrangement involves the same high number of left turns for arriving and leaving vehicles as with a four-way stop or traffic signal. If the direction of traffic within the Tilton Rentall property was reversed, the roundabout affords the opportunity for all visitors to enter the entrance on Barnes Road and exit onto the Edgartown – Vineyard Haven with only right turns . . . much quicker and safer.

Other Impacts: As noted above, all construction is expected to take place in the existing public road layout with the exception of the multi-user paths, which, with alternatives 4 and 5, would slightly impinge on the Vineyard Youth Tennis and Land Bank properties on the south side.

5.6 Cost

The cost of installing traffic signals including related expenses would be about $150,000. The cost of building four turning lanes would be an additional $250,000 (including full-depth construction along each approach, resurfacing of the intersection, and modifications to the MUP. The total cost of building a roundabout would be about the same order of magnitude, namely $400,000 to $450,000. In both cases, the annual operating costs for alternatives 3, 4, and 5 would likely be about $1000. With a traffic signal, the expenses are for electricity, maintenance of loops, controller, signal heads, timing plans, and replacement of signal heads and controllers. With the roundabout, maintenance costs are for landscape maintenance and occasional sign replacement.[6]

Construction Costs *(thousands)*					
Alternative	***1***	***2***	***3***	***4***	***5***
Construction	*$0*	*$125**	*$150*	$400*	$400 - $450
The cost of options 2 and 4 could be increased by $125,000 if it is necessary to relocate the telephone switching box located on the southwest corner of the intersection. Construction costs estimated by Greenman-Pederson Inc for this report and based on recent experience in Nantucket					

Financing: MassHighway and the Federal Highway Administration (FHWA) would fund the construction costs. The Vineyard's Joint Transportation Committee, made up of representatives of the six Island towns, the County, the VTA, the MVC, and of Vineyard citizens, made the roundabout the main project of the Vineyard's Transportation Improvement Program (TIP) for fiscal year 2005. Since the JTC's criteria for prioritizing projects mainly deal with safety and congestion issues, the committee would likely be prepared to support a request from the Town of Oak Bluffs to recommend in favor of TIP funding for a project in this location, particularly if it did not lead to a decrease in safety. Based on FHWA regulations, the Town of Oak Bluffs would be responsible for the relatively modest design fee.

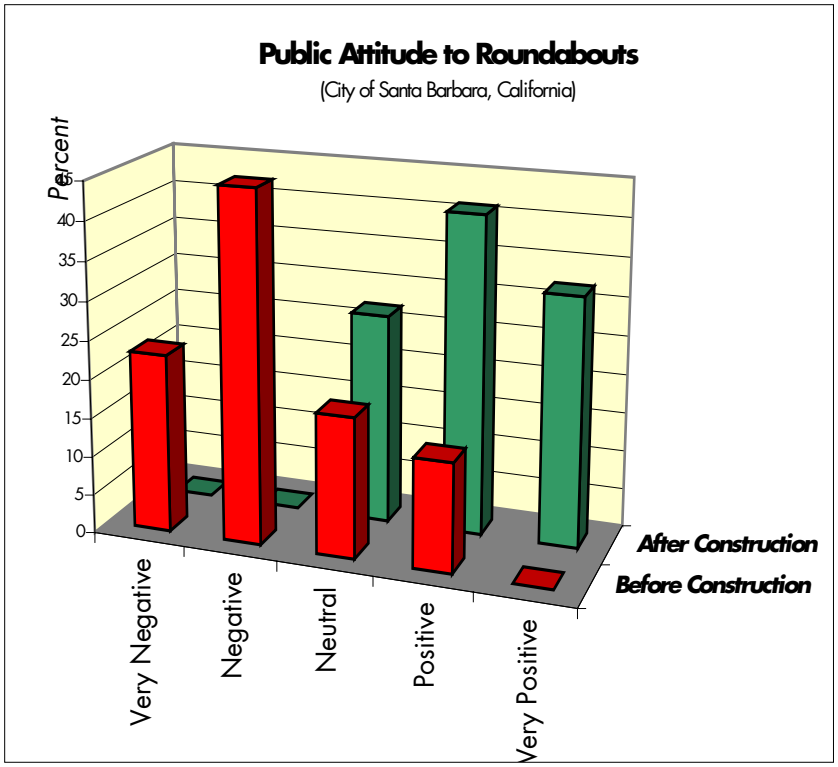
5.7 Public Support

A public opinion survey carried out by the Martha's Vineyard Commission in 2004 indicated that only 40% of year-round residents and 34% of seasonal residents favored installing traffic signals on the Island.

The fact that there was a petition against the 2004 proposal to build a roundabout indicates public misgivings about this alternative. This is not unusual before a roundabout is built, especially in the Northeast where the public often confuses them with rotaries. A study by the Insurance Institute for Highway Safety states that, "American motorists often say they don't like roundabouts, but experience quickly wins them over." Researchers surveyed drivers before and after several roundabouts were built. "The proportion of drivers in favor doubled overall, from 31 percent before construction to 63% after. Those who were strongly opposed dropped from 41 to 15 percent." A survey before and after construction of a roundabout in Santa Barbara showed that before

[6] *Alternative Traffic Controls: Roundabouts, Michael J. Wallwork, and recent information from Greenman Pederson Inc.*

construction, opinion was 68% against; after construction, it was 73% in favor. A similar survey after construction of a roundabout in Montpelier showed 56% had a positive opinion, 15% had an unfavorable opinion, and 29% had a neutral opinion, with the breakdown similar for motorists, cyclists and pedestrians.[7]



[7] *Modern Roundabout Practice in the United States, Transportation Research Board, National Research Council, 1998, page 20.*

Summary of Pros and Cons					
	Alternative 1 (Existing – compared to other alternatives)	*Alternative 2 (Right Turn Lane)*	*Alternative 3 (Traffic Signal)*	*Alternative 4 (Traffic Signal with turning lanes)*	*Alternative 5 Roundabout*
Pros	*No cost.* *No additional road construction.*	*Limited cost.* *Some improvement to congestion and delays.*	*Lower accident rate.* *Reduced congestion and delays.* *Improved air quality.* *Improved pedestrian and bicycle safety.* *No additional road construction.*	*Lower accident rate.* *Reduced congestion and delays.* *Improved pedestrian and bicycle safety.*	*Lowest accident rate.* *Least congestion and delays.* *Improved pedestrian and bicycle safety.* *Opportunity for landscaping.*
Cons	*High accident rate.* *High congestion and delays.* *Poor air quality.*	*High accident rate.* *High congestion and delays.* *Poor air quality.*	*Still relatively high accident rate.* *Still relatively high congestion.* *Moderate air quality as half of traffic must stop and wait.* *First traffic signal on Island.* *Relatively high cost.*	*Still relatively high accident rate.* *Moderate air quality as half of traffic must stop and wait.* *First traffic signal on Island.* *Large, "un-Vineyard" intersection.* *High cost.*	*High cost.*

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- NorthEast Area Roundabouts, www.members.cox.net/near.

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